National Semiconductor

December 1994

54F/74F14 Hex Inverter Schmitt Trigger

General Description

The ’F14 contains six logic inverters which accept standard TTL input signals and provide standard TTL output levels. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. In addition, they have a greater noise margin than conventional inverters.

Each circuit contains a Schmitt trigger followed by a Darlington level shifter and a phase splitter driving a TTL totem-pole output. The Schmitt trigger uses positive feed back to effectively speed-up slow input transition, and provide different input threshold voltages for positive and negative-going transitions. This hysteresis between the positive-going and negative-going input thresholds (typically 800 mV) is determined internally by resistor ratios and is essentially insensitive to temperature and supply voltage variations.

Features

- Guaranteed 4000V minimum ESD protection
- Standard Military Drawing
  — 5962-88752

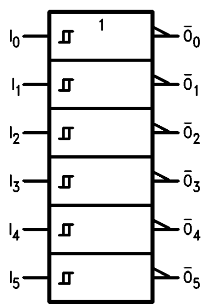
Commercial	Military	Package Number	Package Description
74F14PC		N14A	14-Lead (0.300″ Wide) Molded Dual-In-Line
	54F14DM (Note 2)	J14A	14-Lead Ceramic Dual-In-Line
74F14SC (Note 1)		M14A	14-Lead (0.150″ Wide) Molded Small Outline, JEDEC
74F14SJ (Note 1)		M14D	14-Lead (0.300″ Wide) Molded Small Outline, EIAJ
	54F14FM (Note 2)	W14B	14-Lead Cerpack
	54F14LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Note 1: Devices also available in 13″ reel. Use Suffix = SCX and SJX.

Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

Logic Symbol

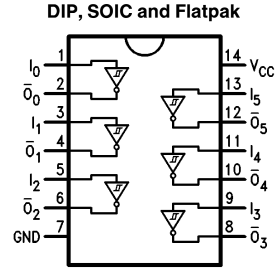
IEEE/IEC



TL/F/9461–3

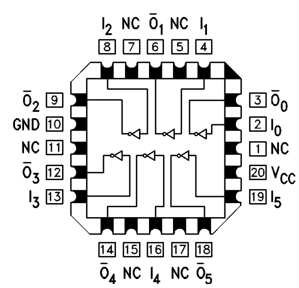
Connection Diagrams

Pin Assignment DIP, SOIC and Flatpak



TL/F/9461–1

Pin Assignment for LCC



TL/F/9461–2

Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
I_n	Input	1.0/1.0	20 µA/−0.6 mA
$\overline{O}_n$	Output	50/33.3	−1 mA/20 mA

Function Table

Input	Output
A	$\overline{O}$
L	H
H	L

H = HIGH Voltage Level
L = LOW Voltage Level

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +175°C
V_{CC} Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Output in HIGH State (with V_{CC} = 0V)	
Standard Output	−0.5V to V_{CC}
TRI-STATE® Output	−0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I_{OL} (mA)
ESD Last Passing Voltage (Min)	4000V

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

Free Air Ambient Temperature	
Military	−55°C to +125°C
Commercial	0°C to +70°C
Supply Voltage	
Military	+4.5V to +5.5V
Commercial	+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter		54F/74F			Units	V_{CC}	Conditions
			Min	Typ	Max			
V_{T+}	Positive-Going Threshold		1.5	1.7	2.0	V	5.0V	
V_{T-}	Negative-Going Threshold		0.7	0.9	1.1	V	5.0V	
ΔV_T	Hysteresis ($V_{T+}-V_{T-}$)		0.4	0.8		V	5.0V	
V_{CD}	Input Clamp Diode Voltage				−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	54F 10% V_{CC} 74F 10% V_{CC} 74F 5% V_{CC}	2.5 2.5 2.7			V	Min	I_{OH} = −1 mA I_{OH} = −1 mA I_{OH} = −1 mA
V_{OL}	Output LOW Voltage	54F 10% V_{CC} 74F 10% V_{CC}			0.5 0.5	V	Min	I_{OL} = 20 mA I_{OL} = 20 mA
I_{IH}	Input HIGH Current	54F 74F			20.0 5.0	μA	Max	V_{IN} = 2.7V
I_{BVI}	Input HIGH Current Breakdown Test	54F 74F			100 7.0	μA	Max	V_{IN} = 7.0V
I_{CEX}	Output HIGH Leakage Current	54F 74F			250 50	μA	Max	V_{OUT} = V_{CC}
V_{ID}	Input Leakage Test	74F	4.75			V	Max	I_{ID} = 1.9 μA All Other Pins Grounded
I_{OD}	Output Leakage Circuit Current	74F			3.75	μA	0.0	V_{IOD} = 150 mV All Other Pins Grounded
I_{IL}	Input LOW Current				−0.6	mA	Max	V_{IN} = 0.5V
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{CCH}	Power Supply Current				25	mA	Max	V_O = HIGH
I_{CCL}	Power Supply Current				25	mA	Max	V_O = LOW

AC Electrical Characteristics

Symbol	Parameter	74F $T_A = +25°C$ $V_{CC} = +5.0V$ $C_L = 50\ pF$		54F $T_A, V_{CC} = Mil$ $C_L = 50\ pF$		74F $T_A, V_{CC} = Com$ $C_L = 50\ pF$		Units
		Min	Max	Min	Max	Min	Max	
t_{PLH}	Propagation Delay	4.0	10.5	4.0	13.0	4.0	11.5	ns
t_{PHL}	$I_n \rightarrow \overline{O}_n$	3.5	8.5	3.5	10.0	3.5	9.0	

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

74F 14 S C X

Temperature Range Family
- 74F = Commercial
- 54F = Military

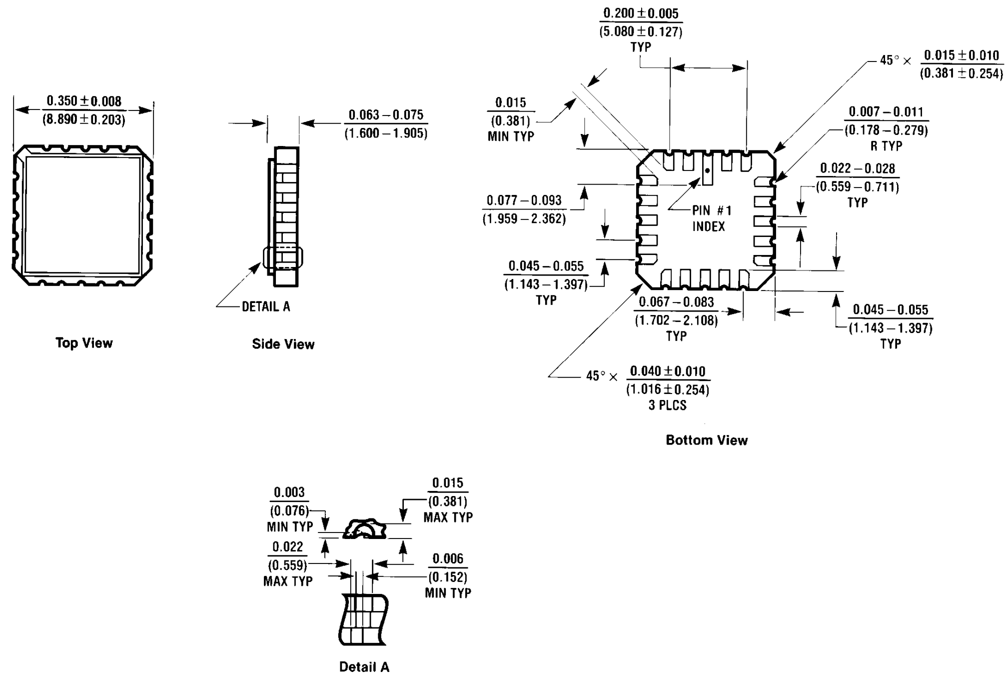
Device Type

Package Code
- P = Plastic DIP
- D = Ceramic DIP
- F = Flatpak
- L = Leadless Chip Carrier (LCC)
- S = Small Outline SOIC JEDEC
- SJ = Small Outline SOIC EIAJ

Special Variations
- QB = Military grade device with environmental and burn-in processing
- X = Devices shipped in 13″ reels

Temperature Range
- C = Commercial (0°C to +70°C)
- M = Military (−55°C to +125°C)

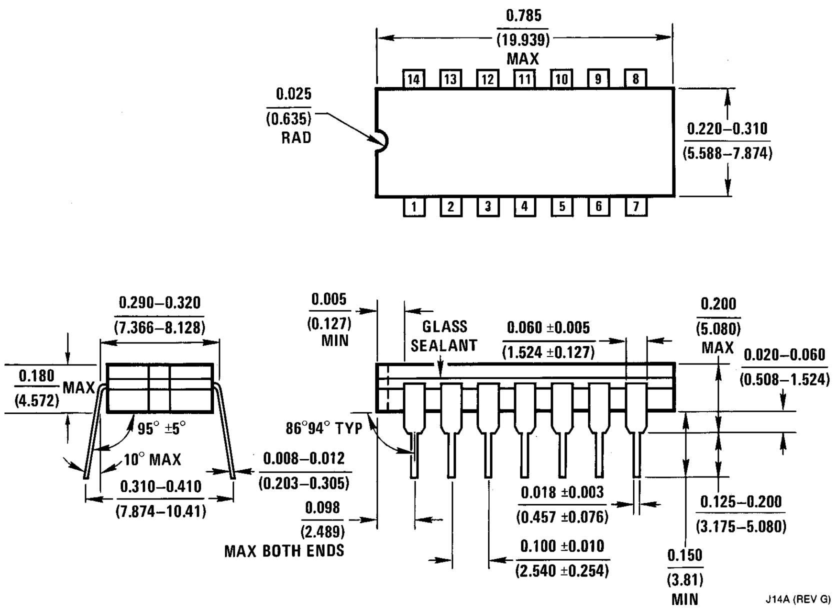
Physical Dimensions inches (millimeters)



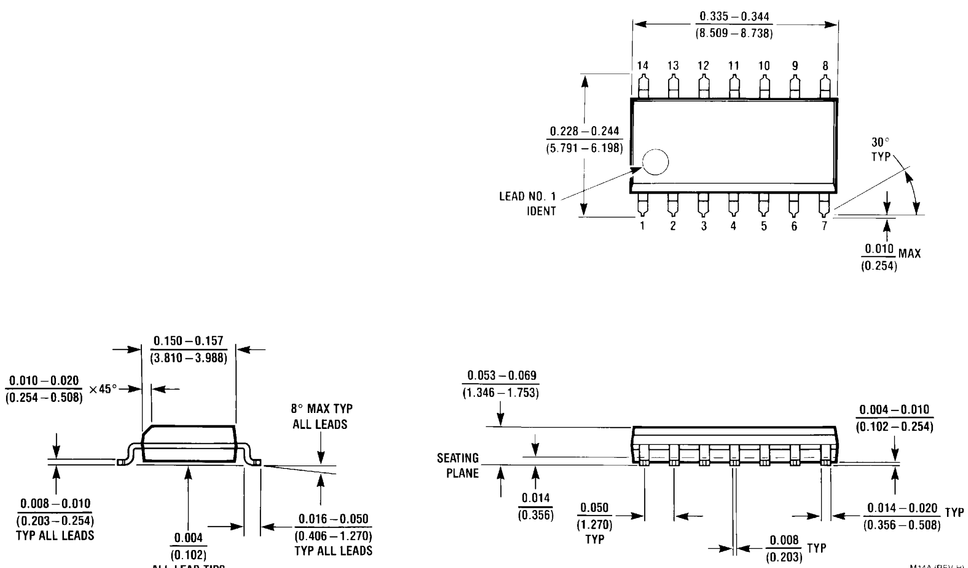
E20A (REV D)

20-Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

Physical Dimensions inches (millimeters) (Continued)

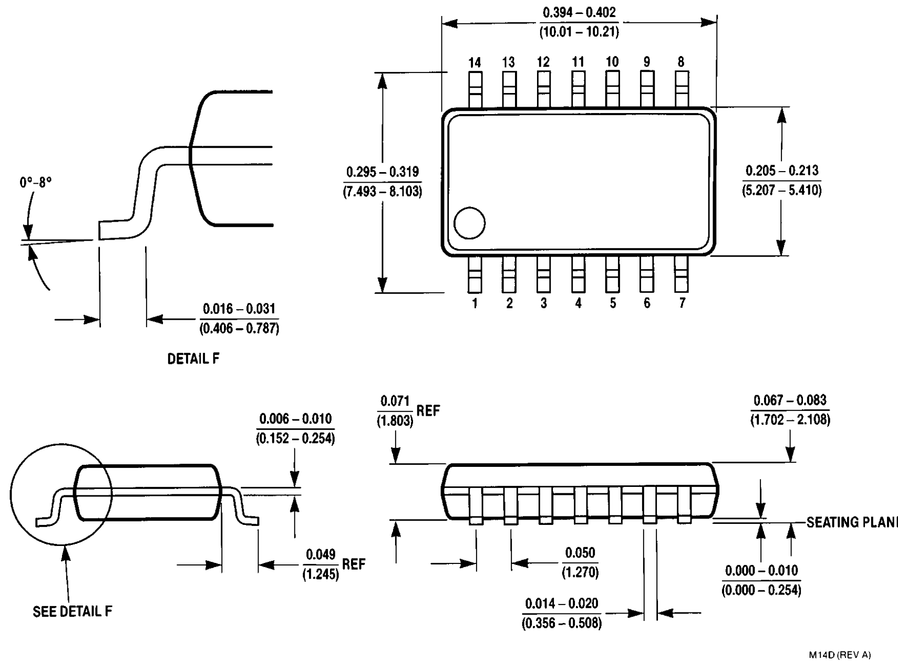


14-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J14A

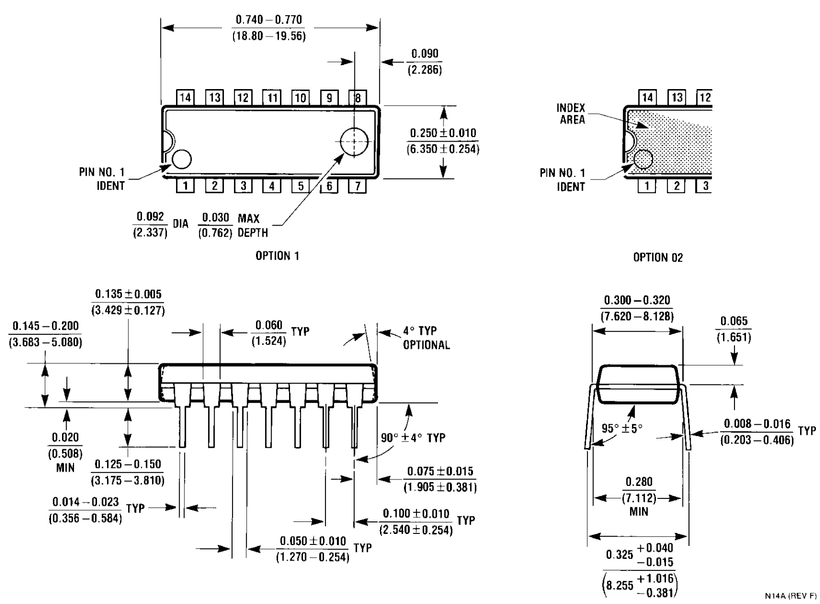


14-Lead (0.150″ Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M14A

Physical Dimensions inches (millimeters) (Continued)

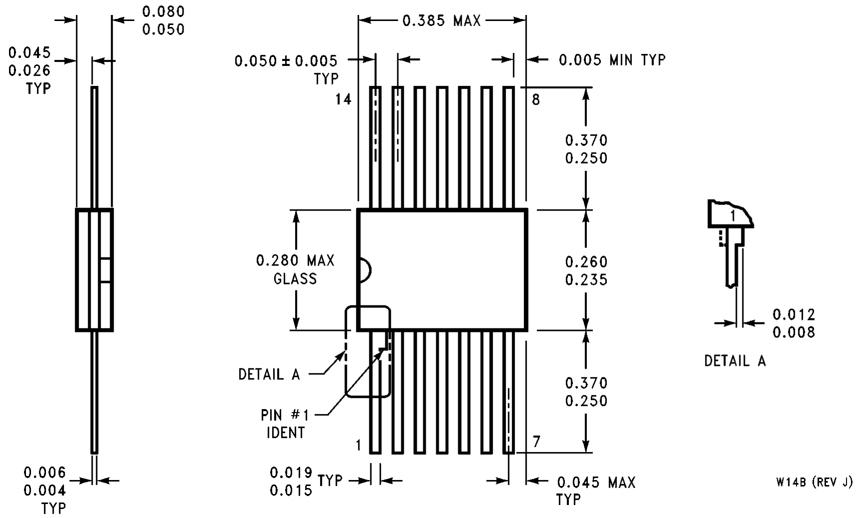


14-Lead (0.300″ Wide) Molded Small Outline Package, EIAJ (SJ)
NS Package Number M14D



14-Lead (0.300″ Wide) Molded Dual-In-Line Package (P)
NS Package Number N14A

Physical Dimensions inches (millimeters) (Continued)



14-Lead Ceramic Flatpak (F)
NS Package Number W14B

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